What is claimed is:

1. In a vehicle having a power source for producing rotational motion, a power take-off shaft for supplying rotational motion to at least one piece of equipment other than the vehicle, and a clutch including an input shaft coupled to the power source and an output shaft coupled to the PTO shaft, wherein the clutch transmits a maximum torque between the input and output shafts in response to a maximum clutch pressure and transmits a selectable torque between the input and output shafts in response to a selected clutch engagement pressure less than the maximum clutch engagement pressure, a power take-off control system comprising:

a first transducer disposed to generate an input shaft speed signal representative of the rotational speed of the input shaft;

a second transducer disposed to generate an output shaft speed signal representative of the rotational speed of the output shaft;

a clutch control configured to effect engagement and disengagement by the clutch in response to engagement control signals applied thereto, the clutch transmitting a selectable torque between the input and output shafts dependent upon a clutch engagement pressure defined by said engagement control signals, wherein the clutch engagement pressure is variable up to the maximum engagement pressure;

a controller coupled to the clutch control, the first transducer, and the second transducer, said controller operable to monitor the input shaft speed signals and the output shaft speed signals generated by said first and second transducers and to produce time-based engagement control signals dependent thereon,

said engagement control signals each including a characteristic representative of an associated amount of clutch pressure to be applied,

said controller operable to generate a first set of time-based engagement control signals during a time period between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected by said controller, and a second set of engagement signals at times subsequent to said detection of movement by the output shaft,

said first set of time-based engagement control signals including a first subset of engagement control signals having characteristics collectively representative of the amount of clutch pressure to be applied over a period of time in a time-ordered fashion, wherein at least one engagement control signal from among said first subset is a shock control signal that has a characteristic defined by a different relationship than the characteristics of the non-shock control signals of said first subset and whose associated clutch pressure is markedly distinguishably greater than and out of character with the clutch pressures associated with the non-shock control signals of said first subset, whereby generation of a shock control signal effects the application of a high clutch pressure for a short time duration at a predetermined time prior to detected movement of the output shaft.

2. The system of claim 1 further comprising a source of pressurized hydraulic fluid, the clutch being a hydraulic clutch engageable at an engagement pressure related to the hydraulic pressure applied to the clutch, the clutch control including a hydraulic valve for coupling the clutch to the source of

pressurized hydraulic fluid, and the hydraulic valve being a proportional valve configured to control the pressure of the fluid applied to the clutch from the source, wherein the pressure is dependent upon the first control signals.

3. The system of claim 2 wherein said controller includes a programmed microprocessor.

4. The system of claim 2 further comprising an over-running clutch associated with the output shaft.

5. The system of claim 3 further comprising an implement coupled to said over-running clutch.

6. The system of claim 2 wherein said controller includes a digital processor configured to produce engagement control signals the magnitudes of which are characteristics representative of associated amounts of clutch pressure to be applied at given times.

7. The system of claim 2 wherein said controller includes a digital processor configured to produce engagement control signals which are pulse-width modulated signals having a predetermined frequency, and the pressure applied to the clutch is substantially proportional to the pulse-width of the modulated signals.

8. The system of claim 7 further including filtering circuitry for coupling the first and second transducers to the digital processor.

9. The system of claim 7 wherein the first and second transducers are magnetic pickups located and proximate the input and output shafts, respectively.

10. The system of claim 1 wherein said first set of engagement control signals includes a plurality of subsets of engagement control signals having characteristics collectively representative of the amount of clutch pressure to be applied over different sequential periods of time in a time-ordered fashion, wherein each subset includes at least one engagement control signal that is a shock control signal which has a characteristic defined by a different relationship than the characteristics of the non-shock control signals of that subset and whose associated clutch pressure is markedly distinguishably greater than and out of character with the clutch pressures associated with the non-shock control signals of that subset, whereby generation of each such shock control signal from a subset effects the application of a high clutch pressure for a short time duration at a predetermined time prior to detected movement of the output shaft.

11. The system of claim 10 wherein the characteristic of at least one shock control signal from said subsets differs from the characteristics of other shock control signals from said subsets.

12. The system of claim 11 wherein said subsets of said first set of engagement control signals are generated in a time-sequenced order and the characteristics of the later generated shock control signals of said subsets are increasingly greater than the characteristics of earlier generated shock control signals of said subsets.

13. The system of claim 1 wherein said second set of engagement control signals includes a first subset of control signals the characteristics of which are dependent upon the rate of change over time of the output shaft speed signals and the input shaft speed signal at a given time, whereby said controller determines a desired acceleration for the output shaft.

14. The system of claim 1 wherein said second set of engagement control signals includes a first subset of control signals the characteristics of which are dependent upon the rate of change over time of the output shaft speed signals and the input shaft speed signal at a the time of engagement control signal generation, whereby said controller repetitively determines a desired acceleration for the output shaft over a period of time.

15. The system of claim 1 wherein said first subset of engagement control signals includes a plurality of shock control signals, said plurality of shock control signals defining a series of shock control signals generated commencing at a given time during the time between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected.

16. The system of claim 1 wherein said first subset of engagement control signals includes first and second pluralities of shock control signals, said first plurality of shock control signals defining a series of shock control signals generated commencing at a first given time during the time between commencement of an engagement operation and the time at which an output

shaft speed signal indicative of movement by the output shaft is detected, said second plurality of shock control signals defining a series of shock control signals generated commencing at a second given time during the time between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected.

17. A method for engaging and operating variable loads on a power take-off shaft in a system having

a power source for producing rotational motion;

a power take-off shaft for supplying rotational motion to at least one piece of equipment coupled to the power take-off shaft;

a clutch including an input shaft coupled to the power source and an output shaft coupled to the PTO shaft, wherein the clutch transmits a maximum torque between the input and output shafts in response to a maximum clutch pressure and transmits a selectable torque between the input and output shafts in response to a given clutch engagement pressure less than the maximum clutch engagement pressure;

a first transducer disposed to generate an input shaft speed signal representative of the rotational speed of the input shaft;

a second transducer disposed to generate an output shaft speed signal representative of the rotational speed of the output shaft;

a clutch control configured to effect engagement and disengagement by the clutch in response to engagement control signals applied thereto, the clutch transmitting a selectable torque between the input and output shafts dependent upon a given clutch engagement pressure defined by said engagement control signals, wherein the clutch engagement pressure is variable up to the maximum engagement pressure;

a controller coupled to the clutch control, the first transducer, and the second transducer, said controller operable to monitor the input shaft speed signals and the output shaft speed signals generated by

said first and second transducers, and to produce time-based engagement control signals dependent thereon,

the engagement control signals each including a characteristic representative of an associated amount of clutch pressure to be applied; and

the controller operable to generate a first set of time-based engagement control signals during a time period between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected by said controller, and a second set of engagement signals at times subsequent to said detection of movement by the output shaft;

the method comprising:

(a) monitoring the input and output shaft speed signals to detect the speeds at given times of the input and output shafts and initial movement of the output shaft as a result of application of engagement control signals;

(b) generating over a first period of time, prior to detection by the controller of initial movement of the output shaft as a result of application of engagement control signals, a sequence of engagement control signals having characteristics associated with increasingly greater clutch pressure to be applied in accordance with a particular pattern;

(c) generating, at at least one time during the first period of time, an engagement control signal that is a shock control signal having a characteristic defined by a different relationship than the characteristics of non-shock control signals generated over the first period of time, the characteristic of the shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of

accordance with the particular pattern of clutch pressures associated with non-shock engagement control signals generated over the first period of time;

(d) following detection of initial movement of the output shaft, generating over a second period of time, prior to detection by the controller of input and output shaft speed signals of like value, a sequence of engagement control signals having characteristics associated with increasingly greater clutch pressure to be applied in accordance with a particular pattern until maximum clutch pressure is realized.

18. The method of claim 17 wherein, at a plurality of predetermined times during said first time period, the controller generates distinct engagement control signals that are shock control signals each having a characteristic defined by a different relationship than the characteristics of non-shock control signals generated over the first period of time, the characteristic of each such shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of accordance with the particular pattern of clutch pressures associated with non-shock engagement control signals generated over the first period of time.

19. The method of claim 17 including the step, upon detection of initial movement of the output shaft and prior to step (d), of

(e) categorizing the load on the power take-off shaft based upon the detected time of initial movement of the output shaft relative to at least one predetermined time;

and wherein the engagement control signals generated in step (d) are dependent upon the load categorization made in step (e).

20. The method of claim 19 wherein the engagement control signals generated in step (d) are dependent upon the rate of change over time of the output shaft speed signals and the input shaft speed signal at a given time, whereby the controller determines a desired acceleration for the output shaft.

21. The method of claim 17 wherein the engagement control signals generated in step (d) are dependent upon the rate of change over time of the output shaft speed signals and the input shaft speed signal at a the time of engagement control signal generation, whereby the controller repetitively determines a desired acceleration for the output shaft over a period of time.

22. The method of claim 17 wherein the engagement control signals have characteristics which are representative of associated amounts of clutch pressure to be applied at given times.

23. The method of claim 17 wherein the engagement control signals are pulse-width modulated signals having a predetermined frequency, and the pressure applied to the clutch is substantially proportional to the pulse-width of the modulated signals.

24. A method for engaging heavy loads on a power take-off shaft in a power take-off operating system having

a power source for producing rotational motion;

a power take-off shaft for supplying rotational motion to at least one piece of equipment coupled to the power take-off shaft;

a clutch including an input shaft coupled to the power source and an output shaft coupled to the PTO shaft, wherein the clutch transmits a maximum torque between the input and output shafts in response to a maximum clutch pressure and transmits a selectable torque between the input and output shafts in response to a given clutch engagement pressure less than the maximum clutch engagement pressure;

a first transducer disposed to generate an input shaft speed signal representative of the rotational speed of the input shaft;

a second transducer disposed to generate an output shaft speed signal representative of the rotational speed of the output shaft;

a clutch control configured to effect engagement and disengagement by the clutch in response to engagement control signals applied thereto, the clutch transmitting a selectable torque between the input and output shafts dependent upon a given clutch engagement pressure defined by said engagement control signals, wherein the clutch engagement pressure is variable up to the maximum engagement pressure;

a controller coupled to the clutch control, the first transducer and the second transducer, said controller operable to monitor the input shaft speed signals and the output shaft speed signals generated by

said first and second transducers, and to produce time-based engagement control signals dependent thereon,

the engagement control signals each including a characteristic representative of an associated amount of clutch pressure to be applied; and

the controller operable to generate a first set of time-based engagement control signals during a time period between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected by said controller, and a second set of engagement signals at times subsequent to said detection of movement by the output shaft;

the method comprising:

(a) monitoring the input and output shaft speed signals to detect the speeds at given times of the input and output shafts and initial movement of the output shaft as a result of application of engagement control signals;

(b) generating over a first period of time, prior to detection by the controller of initial movement of the output shaft as a result of application of engagement control signals, a sequence of engagement control signals having characteristics associated with increasingly greater clutch pressure to be applied in accordance with a particular pattern;

(c) generating, at at least one time during the first period of time, an engagement control signal that is a shock control signal having a characteristic defined by a different relationship than the characteristics of non-shock control signals generated over the first period of time, the characteristic of the shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of

accordance with the particular pattern of clutch pressures associated with non-shock engagement control signals generated over the first period of time.

25. The method of claim 24 wherein, at a plurality of predetermined times during said first time period, the controller generates distinct engagement control signals that are shock control signals each having a characteristic defined by a different relationship than the characteristics of other engagement control signals generated over the first period of time, the characteristic of each such shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of accordance with the particular pattern of clutch pressures associated with other non-shock engagement control signals generated over the first period of time.

26. The method of claim 23, further including the step of

(d) generating, following detection of initial movement of the output shaft, over a second period of time, prior to detection by the controller of input and output shaft speed signals of like value, a sequence of engagement control signals having characteristics associated with increasingly greater clutch pressure to be applied in accordance with a particular pattern until maximum clutch pressure is realized.

27. The method of claim 26, further including the step of

(e) categorizing the load on the power take-off shaft based upon the detected time of initial

movement of the output shaft relative to at least one predetermined time;

and wherein the engagement control signals generated in step (d) are dependent upon the load categorization made in step (e).

28. The method of claim 24 wherein the engagement control signals have characteristics which are representative of associated amounts of clutch pressure to be applied at given times.

29. A method for engaging variable loads on a power take-off shaft in a system having

a power source for producing rotational motion;

a power take-off shaft for supplying rotational motion to at least one piece of equipment coupled to the power take-off shaft;

a clutch including an input shaft coupled to the power source and an output shaft coupled to the PTO shaft, wherein the clutch transmits a maximum torque between the input and output shafts in response to a maximum clutch pressure and transmits a selectable torque between the input and output shafts in response to a given clutch engagement pressure less than the maximum clutch engagement pressure;

a first transducer disposed to generate an input shaft speed signal representative of the rotational speed of the input shaft;

a second transducer disposed to generate an output shaft speed signal representative of the rotational speed of the output shaft;

a clutch control configured to effect engagement and disengagement by the clutch in response to engagement control signals applied thereto, the clutch transmitting a selectable torque between the input and output shafts dependent upon a given clutch engagement pressure defined by said engagement control signals, wherein the clutch engagement pressure is variable up to the maximum engagement pressure;

a controller coupled to the clutch control, the first transducer, and the second transducer, said controller operable to monitor the input shaft speed signals and the output shaft speed signals generated by said first and second transducers, and to produce time-based engagement control signals dependent thereon,

the engagement control signals each including a characteristic representative of an associated amount of clutch pressure to be applied; and

the controller operable to generate a first set of time-based engagement control signals during a time period between commencement of an engagement operation and the time at which an output shaft speed signal indicative of movement by the output shaft is detected by said controller, and a second set of engagement signals at times subsequent to said detection of movement by the output shaft;

the method comprising:

(a) monitoring the input and output shaft speed signals to detect the speeds at given times of the input and output shafts;

(b) periodically checking to determine if output shaft movement has occurred and

(1) if output shaft movement has occurred, proceeding to generate the second set of engagement signals; or

(2) if output shaft movement has not occurred and the time of the check is not a given time after commencement of the engagement operation, applying an engagement control signal having characteristics associated with a pattern of increasingly greater clutch pressure; or

(3) if output shaft movement has not occurred and the time of the check is a given time after commencement of the engagement operation, thereafter generating, at at least

one time during the first period of time, an engagement control signal that is a shock control signal having a characteristic defined by a different relationship than the characteristics of non-shock control signals generated over the first period of time, the characteristic of the shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of accordance with the particular pattern of clutch pressures associated with non-shock engagement control signals generated over the first period of time.

30. The method of claim 29 wherein, at a plurality of predetermined times during said first time period, the controller generates distinct engagement control signals that are shock control signals each having a characteristic defined by a different relationship than the characteristics of non-shock control signals generated over the first period of time, the characteristic of each such shock control signal being associated with a markedly and distinguishably higher clutch pressure and out of accordance with the particular pattern of clutch pressures associated with non-shock engagement control signals generated over the first period of time.

31. The method of claim 29 wherein generation of the second set of time-based engagement control signals includes the step of

(c) generating over a second period of time, prior to detection by the controller of input and output shaft speed signals of like value, a sequence of engagement control signals having characteristics associated with increasingly greater clutch pressure to be applied in accordance with a particular pattern until maximum clutch pressure is realized.

32. The method of claim 31 wherein generation of the second set of time-based engagement control signals includes the step, prior to step (c), of categorizing the load on the power take-off shaft based upon the detected time of initial movement of the output shaft relative to at least one predetermined time, and wherein the engagement control signals generated in step (c) are dependent upon such load categorization.

33. The method of claim 29 wherein step (b)(2) includes the generation of a series of shock control signals.